G-LiHT Webmap: Over 100 Billion Laser Pulses Served

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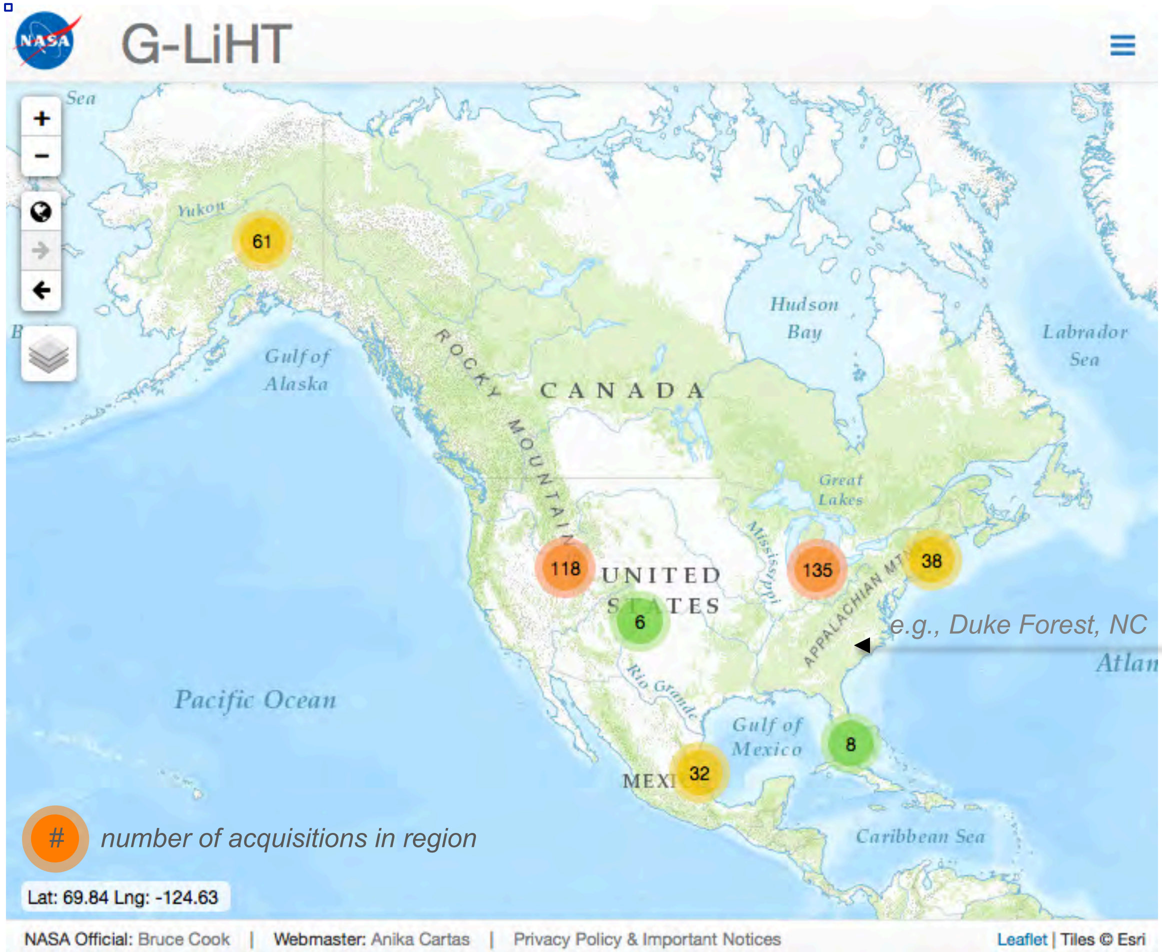
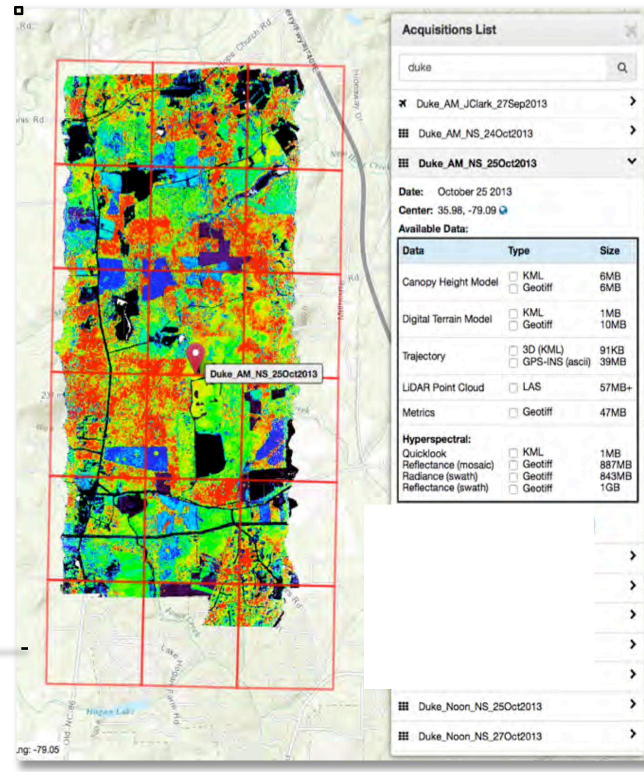


Preview and Data Selection Tool



Goddard's Lidar, Hyperspectral and Thermal (G-LiHT) has collected multi-sensor airborne image data from Alaska to the Yucatan for NASA Missions and research funded through NASA ROSES, US Forest Service and Department of Defense.

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References:

G-LiHT airborne system and data products:

Cook, B. D., L. W. Corp, R. F. Nelson, E. M. Middleton, D. C. Morton, J. T. McCorkel, J. G. Masek, K. J. Ranson, and V. Ly. 2013. NASA Goddard's Lidar, Hyperspectral and Thermal (G-LiHT) airborne imager. *Remote Sensing* 5:4045-4066. doi:10.3390/rs5084045.

Recent examples of other Earth Science studies enabled by open-access G-LiHT data:

Neigh, C., J. G. Masek, P. Bourget, K. Rishmawi, F. Zhao, C. Huang, B. Cook, and R. Nelson. 2016. Regional rates of US forest growth measured from annual Landsat disturbance history and IKONOS stereo imagery. *Remote Sensing of Environment*. 173:282-293, doi:10.1016/j.rse.2015.09.007.

Van Den Hoek, J., J. S. Read, L. A. Winslow, P. Montesano and C. D. Markfort. 2015. Examining the utility of satellite-based wind sheltering estimates for lake hydrodynamic modeling. *Remote Sensing of Environment* 156:551-560. doi:10.1016/j.rse.2014.10.024.

Duncanson, L., B. Cook, J. Rosette, G. Parker and R. Dubayah. 2015. The importance of spatial detail: Assessing the utility of individual crown information and scaling approaches for lidar-based biomass density estimation. *Remote Sensing of Environment* 168:102-112. doi:10.1016/j.rse.2015.06.021.

Hernandez-Stefanoni, J. L., K. Johnson, B. Cook, J. Dupuy, R. Birdsey, A. Peduzzi, and F. Tun-Dzul. 2015. Estimating species richness and biomass of tropical dry forests using lidar during leaf-on and leaf-off canopy conditions. *Applied Vegetation Science*, 18:724-732. doi:10.1111/avsc.12190.

Ni, W. K. J. Ranson, Z. Zhang and G. Sun. 2014. Features of point clouds synthesized from multi-view ALOS/PRISM data and comparisons with LiDAR data in forested areas. *Remote Sensing of Environment* 149:47-57. doi:10.1016/j.rse.2014.04.001.

Finley, A., S. Banerjee and B. D. Cook. 2014. Bayesian hierarchical models for spatially misaligned data in R. 2014. *Methods in Ecology and Evolution* 5:514-523. doi: 10.1111/2041-210X.12189.

Data Sources: Goddard's Lidar, Hyperspectral and Thermal (G-LiHT) airborne imager (http://gliht.gsfc.nasa.gov). Since 2011, G-LiHT has flown a total of ***952 flight hours*** (including short transits), recorded lidar returns from ***104 billion laser pulses***, and imaged ***20,482 km^2***. Acquisitions have included ***57,030 ICESat-GLAS footprints*** (45,878 CONUS; 11,152 Mexico); ***1,383 National Forest Inventory plots*** (895 CONUS; 190 Alaska; 298 Mexico); ***14 flux towers (***9 CONUS; 3 Alaska; 2 Mexico); **8 large stem map areas** (7 CONUS; 1 Alaska); ***24 sites with repeat lidar*** (18 CONUS; 4 Alaska; 2 Mexico); **Landsat 7 and 8 under flights** during commissioning; and ***characterization of pseudo-invariant calibration sites for EOS cross-validation***.

Technical Description of Figures: Screen shot of G-LiHT webmap showing distribution of acquisitions throughout North America (left), and selection tool (right) that permits users to preview acquisitions and select individual lidar, image spectroscopy products for downloading. These G-LiHT datasets were acquired to support NASA missions (e.g., ICESat, ICESat-2, Landsat, CLARREO, PACE); joint agency field campaigns (*e.g.,* ESA, USFS); and research research funded through NASA ROSES (Carbon Cycle Science; Carbon Monitoring System; Terrestrial Ecology), USFS (Forest Inventory and Analysis; Forest Health Protection), and DoD. A novel webmap interface developed by NASA GSFC Code 618 scientists provides ***open access to ~3 TB of user-friendly G-LiHT products*** for use by the larger science community and benefit of the public: Digital Terrain and Canopy Height Models, 3D Lidar point clouds and statistical metrics, VNIR radiance and at-sensor reflectance, Radiant surface temperature.

Scientific significance, societal relevance, and relationships to future missions: NASA airborne science data represents a public investment, and simplifying access to user-friendly products maximizes the return on this investment. G-LiHT's webmap and user-friendly data products allow the larger user community to find innovative uses for these data, and to address Earth Science questions both within and beyond the scope of the missions and projects that funded these acquisitions. The webmap interface was developed by scientists at NASA GSFC to serve the needs of G-LiHT and other Code 618 airborne instruments (i.e., DBSAR, EcoSAR), and will continue to benefit future Earth Science missions and research (e.g., GEDI, NISAR, ABoVE).

Innovations in information management and access for assessments

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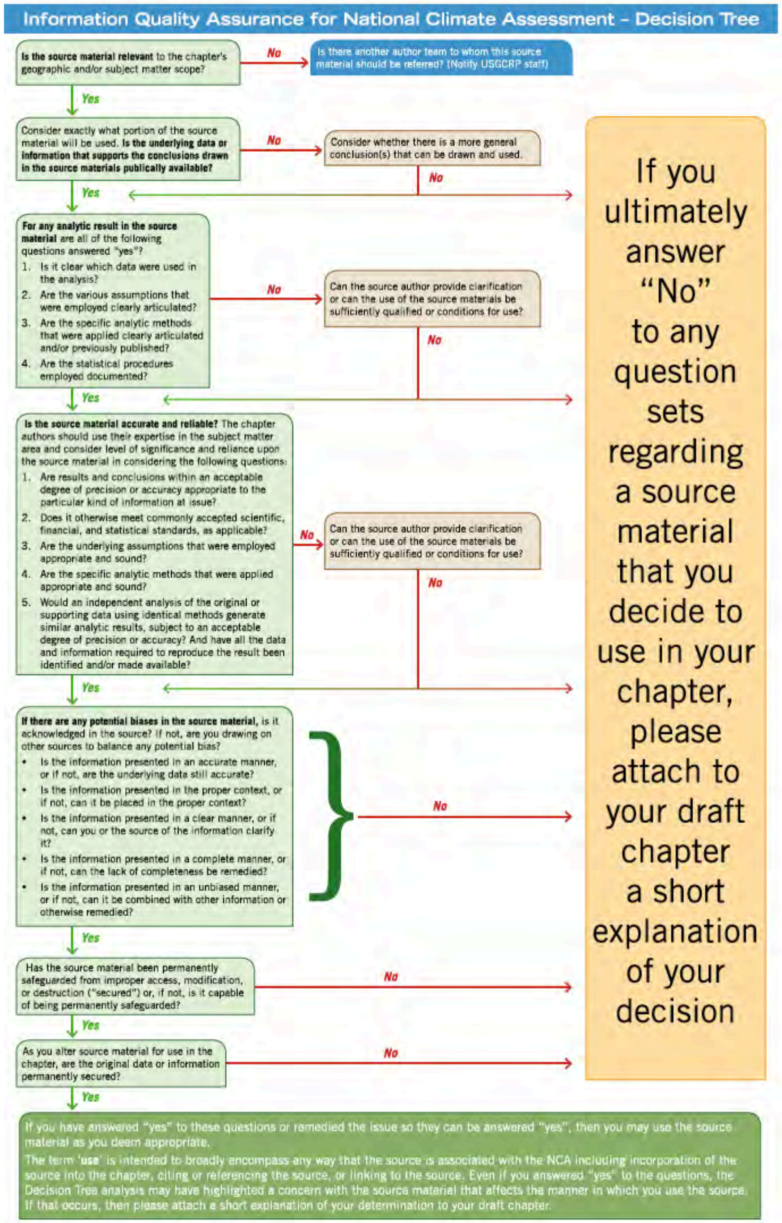

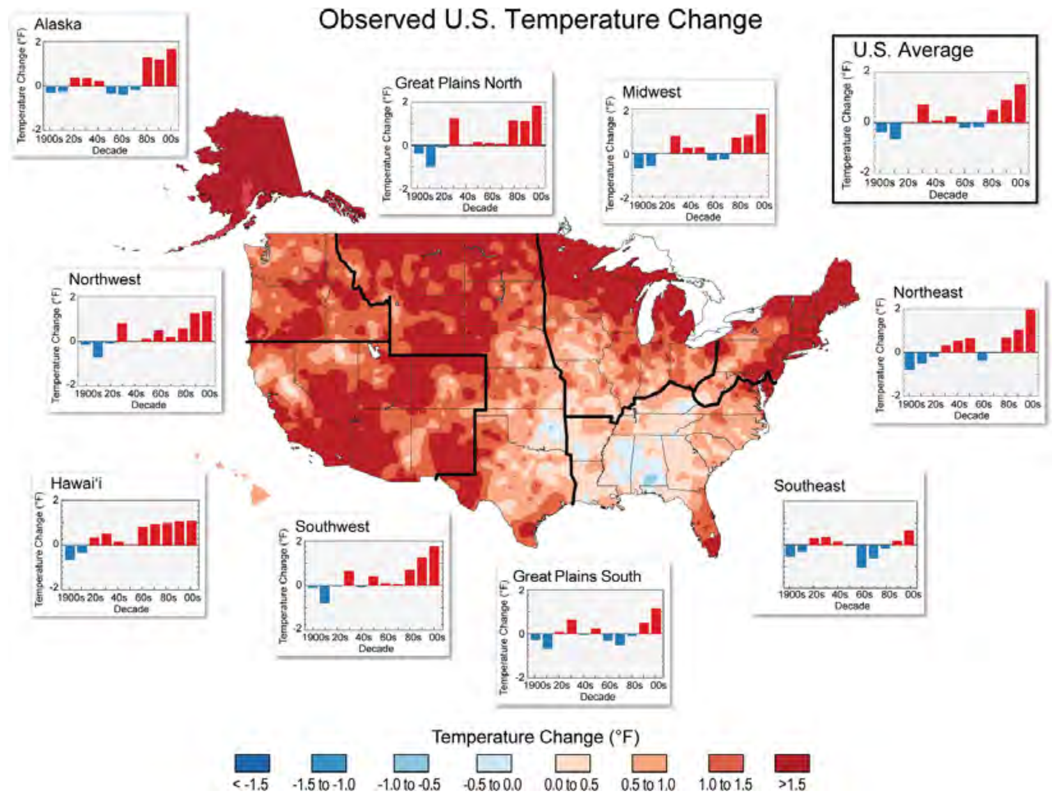

The Decision Tree is used for source material in the National Climate Assessment.

An example of a single National Climate Assessment figure has 11 images derived from 2 datasets, described by nearly 300 metadata field inputs documenting the provenance of the graphic.

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References:

Anne M. Waple, Sarah M. Champion, Kenneth E. Kunkel, Curt Tilmes. Innovations in information management and access for assessments. *Climatic Change*. March, 2016. Volume 135, Issue 1, pp 69-83. doi:10.1007/s10584-015-1588-7

Data Sources:

National Climate Assessment: http://nca2014.globalchange.gov/
Global Change Information System: http://data.globalchange.gov/

Technical Description of Figures:

Graphic 1:

A summary of the decision tree developed by the National Climate Assessment (NCA) Development and Advistory Committee (NCADAC, the federal advisory committee for the NCA), Working Group 6, charged with data management for the report. The tree was intended to assure that the technical information supporting the report was in compliance with the Information Quality Act (IQA). For the detailed tree, see the paper referenced above.

Graphic 2:

Figure 2.7 from chapter 2 of *Climate Change Impacts in the United States: The Third National Climate Assessment*, this figure is described in more detail online:
http://data.globalchange.gov/report/nca3/chapter/our-changing-climate/figure/observed-us-temperature-change

Scientific significance, societal relevance, and relationships to future missions:

The third National Climate Assessment (NCA3) included goals for becoming a more timely, inclusive, rigorous, and sustained process, and for serving a wider variety of decision makers. In order to accomplish these goals, it was necessary to deliberately design an information management strategy that could serve multiple stakeholders and manage different types of information - from highly mature government-supported climate science data, to isolated practitioner-generated case study information - and to do so in ways that are consistent and appropriate for a highly influential assessment. This paper describes the approach used for NCA3 and lessons learned that could improve future assessment reports.